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Small Satellite Regulation in 2020

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ABSTRACT

Small satellite innovation has advanced at a rapid pace over the past decade, but until recently satellite licensing procedures have lagged behind technological innovation, imposing significant regulatory and financial burdens on small satellite operators during early stages of system development. In late 2019, the Federal Communications Commission (FCC) adopted rules creating a new, optional licensing process for small satellites meeting certain criteria, such as a wet mass of 180 kg or less, a shorter in-orbit lifetime, and a low orbital debris risk. Satellite systems meeting these and other criteria may apply for FCC authorization or U.S. market access under a streamlined application process with reduced fees, decreasing barriers to entry for qualifying operators and enabling the deployment of low-cost satellite systems. This new licensing process is in addition to the FCC's existing processes for satellite authorization, including its experimental (part 5), amateur (part 97), and standard commercial satellite licensing procedures (part 25). Small satellite operators seeking to provide service in the United States now have a variety of licensing options to choose from, and will need to select the licensing procedure that best matches their operational and spectrum needs.

In addition to the FCC, satellite licensing involves a variety of other federal agencies. As part of the FCC authorization process, the FCC will coordinate spectrum use with the National Telecommunications and Information Administration (NTIA). The Federal Aviation Administration (FAA) licenses commercial launch and reentry vehicles well as commercial spaceports. Commercial remote sensing satellites require a license from the National Oceanic and Atmospheric Administration (NOAA). The Departments of Commerce and State license exports of space technology. The Department of State also maintains a registry of U.S. space objects. This paper gives an overview of the licensing and authorization regimes in the United States as they apply to small satellite operations.

SMALL SATELLITE REGULATION IN 2020[1]

INTRODUCTION

Regulatory compliance is as important to the success of small satellite missions as good engineering. Failure to plan accordingly and comply with the rules set by regulatory agencies can result in missed launch opportunities, costly system redesigns, and significant penalties. To avoid these and other problems, regulatory compliance should play an important role in small satellite mission planning from the earliest stages all the way through launch, operation, and post-mission disposal. This white paper provides an introduction to the current state of small satellite regulation in the United States, including an overview of applicable licensing procedures and federal rules likely to arise as small satellite operators move towards operational status. The intent of this paper is to provide small satellite operators with basic tools to identify and address regulatory issues throughout development of their systems. While this guide will provide helpful information for all small satellite operators, the issues and procedures discussed herein will be particularly helpful for small companies looking for a regulatory path towards commercial operations in the United States.

This white paper focuses on the regulations and licensing procedures of the Federal Communications Commission (FCC) as they apply to small satellite operators. Next, this paper discusses spectrum access and regulation, including both the domestic and international components of spectrum access. Finally, this paper provides a brief overview of the other federal agencies that play an important role in small satellite regulation in the United States.

I. FCC SATELLITE APPLICATION PROCESS AND RULES

For most non-governmental small satellite operators, obtaining a spectrum license and complying with FCC rules are likely to be the most significant regulatory hurdles to commencing service in the United States. The FCC serves as the gatekeeper for access to non-federal spectrum, and an FCC authorization is typically required for satellites communicating with earth stations operating in the United States as well as for those U.S. earth stations. The FCC also plays a key role in U.S. regulation of orbital debris mitigation. The FCC has traditionally regulated space stations in two broad categories: geostationary orbit (GSO) satellites, which, as the name implies, operate in geostationary orbit, and non-geostationary orbit (NGSO) satellites, which covers satellites operating in any orbit other than GSO. With the proliferation of small satellites in recent years, the FCC has adopted additional regulatory procedures to facilitate authorization of smaller satellites with certain characteristics. The various types of satellite authorizations provided by the FCC are discussed below, along with an overview of the FCC's orbital debris mitigation rules.

The FCC's rules offer three different frameworks for licensing satellites: (1) licensing of a broad range of satellite operations under the Part 25 rules, administered primarily by the Satellite Division of the FCC's International Bureau, which grants authorizations for both earth stations (or "uplink" component of operations) and space stations (or "downlink"); (2) licensing under the Part 5 rules governing experimental operations; and (3) licensing under the Part 97 rules governing amateur radio operations. With the proliferation of small satellites in recent years, the FCC has adopted streamlined regulatory procedures to facilitate authorization of certain small satellites under the Part 25 rules. The various types of satellite authorizations provided by the FCC are discussed below, along with an overview of the FCC's orbital debris mitigation rules.

A. Streamlined Small Satellite Application Process

In recognition of the growing small satellite industry, the FCC opened a proceeding to develop a more flexible licensing process for certain small satellite constellations. The FCC noted that existing licensing processes for satellites were not easily adapted to the rapidly evolving small satellite sector. Unlike larger NGSO constellations, many small satellites are launched as a part of small-scale operations consisting of a limited number of satellites. In 2019, the FCC adopted a streamlined application process for small satellite operations under its Part 25 rules, provided they meet certain qualifications.[2] With the adoption of these rules, the FCC sought to provide less established small satellite operators a faster and less costly path to authorization and operations.

General Requirements. Under the streamlined small satellite application process, operators must provide basic legal and technical information with their satellite applications.[3] This information allows the FCC to determine whether the applicant is qualified to hold an FCC authorization and the proposed operations will conform to the FCC's rules. Small satellite systems are eligible for licensing under the streamlined application process if they meet certain requirements, including the following:

- 10 or fewer satellites under a single authorization;
- Satellite in-orbit lifetime of six years or less;
- Maximum satellite wet mass (including any propellant) of 180 kg;
- The satellites must either possess propulsion capabilities or deploy below 600 km in altitude (small satellites may be deployed above 600 km if the operator certifies that the satellites have sufficient propulsion capabilities to perform collision avoidance maneuvers and deorbit within the in-orbit lifetime term);[4]
- The satellites must be able to share use of the authorized frequency bands with existing operations while not materially constraining future satellite entrants seeking to use the band;
- Satellites must pose relatively low risk from an orbital debris perspective, and must not plan any release of debris.[5]

Fees. Applications for streamlined small satellite operations are subject to a $30,000 fee per application for both U.S.-licensed operators and non-U.S.-licensed satellite operators seeking access to the U.S. market. Small satellite operators are also granted a one-year grace period from posting a $1 million surety bond required for new Part 25 satellite licenses.[6] If an operator is able to launch and operate the satellite system contemplated under the license during this grace period, the operator will not be required to post a surety bond. If the operator is not able to satisfy this requirement, it will be required to post the bond when the one year grace period expires. An operator is permitted to seek multiple authorizations from the FCC and will be required to pay $30,000 for each application.

Spectrum Access. Under the streamlined process, qualified applicants are exempt from the FCC's processing round procedures and will be considered individually. Streamlined small satellite operators are required to operate on a non-interference basis relative to satellites regularly authorized in the same service under Part 25. In their applications, operators must certify that they will not cause interference to existing operators or unreasonably preclude future operators from utilizing the same frequency bands. When selecting frequency bands for small satellite operations, operators should be aware that prior to application filing or grant, coordination with other FCC bureaus or offices and/or with federal government (federal) and non-federal users may be required.

Other Considerations. Satellite constellations initially operating under a small satellite license may eventually transition to regular Part 25 licensing as the operator's business grows.[7] The FCC did not adopt a specific mechanism for this transition, but small satellite operators may apply for a regular Part 25 authorization at any time.

B. Regular Part 25 NGSO Authorizations

Regular Part 25 licensing procedures remain available to commercial operators of small and large satellites. As the FCC has noted, however, "obtaining a Part 25 regular commercial authorization for an NGSO system can be challenging for some small satellite applicants because of the costs and timelines involved, as compared to the overall scope of most small satellite enterprises."[8] Regular Part 25 NGSO authorizations come with a much higher price tag and a requirement to provide a more detailed technical showing. Consequently, regular Part 25 authorizations are more suitable for constellations that are larger, have longer duration missions, or require greater interference protection.

General Requirements. The basic requirements for obtaining a regular Part 25 authorization are similar to those for the streamlined small satellite process, including the requirement to provide basic legal and technical information to the FCC. However, rather than certifying compliance with certain characteristics as in the streamlined small satellite process, regular Part 25 applicants are required to provide detailed narratives and technical analyses with their applications. GSO and NGSO satellites are typically licensed for fifteen years under the regular Part 25 rules compared to the six years under a streamlined small satellite license.[9]

Spectrum Access. Under the regular Part 25 application procedures, NGSO applicants are subject to a modified processing round under which the FCC determines that an initial NGSO application to use a particular frequency band is acceptable for filing and opens a processing round allowing consideration of other NGSO applications seeking the use of the same frequencies. Such other NGSO applications that are filed by a specified cut-off date are considered to have equal priority with the initial application that commenced the processing round.[10] As a result, each of the applicants authorized in the same processing round generally will have the same spectrum access rights. With respect to each frequency band authorized in a processing round, the FCC determines how the spectrum will be shared among equal priority systems to prevent interference with other NGSO systems authorized in the same (or prior) processing round,

while still ensuring that each has access to sufficient spectrum. The FCC may utilize band splitting or band sharing (based on frequency coordination agreements) approaches or some hybrid thereof. Depending on the number of participants in a processing round and the frequency bands involved, processing rounds generally take a year or more for the FCC to complete.

Fees. The application fee for a U.S.-licensed NGSO constellation is $471,575 compared to $30,000 for a streamlined small satellite application. Foreign-licensed NGSO operators seeking U.S. market access are not required to pay an application fee. Upon grant of a regular Part 25 authorization, the NGSO operators (both U.S.-licensed and foreign-licensed operators approved for U.S. market access) are required to post an initial installment of an escalating surety bond which requires $1,000,000, with additional amounts to be posted during a six-year milestone period.[11] Operators are required to maintain the bond until the International Bureau has determined that the operator has met the FCC's milestone requirements.[12] The license holder is responsible for obtaining an ITU filing and must commit to pay cost recovery fees.

C. Small Satellite Authorizations for Non-Commercial Operations

Experimental licenses (Part 5). Experimental satellite operations are limited to non-commercial uses under Part 5 of the FCC's rules. Typically, experimental authorizations are granted for a two- or five-year term for the licensee to engage in experimentation in scientific or technical radio research, market trials and product development. To obtain an experimental authorization, the applicant must demonstrate that the satellite operations are compatible with and will not cause harmful interference to other operations in the frequency band. While experimental operations may be licensed on a non-interference basis in any frequency band, the FCC encourages proposed operations to be consistent with the U.S. Table of Frequency allocations, and will impose conditions to protect incumbent operations as appropriate. Experimental satellite operators are responsible for obtaining an ITU filing and must commit to pay cost recovery fees.

Amateur operations (Part 97). The FCC authorizes amateur satellite operations in frequency bands allocated for amateur use under Part 97 of the rules. Amateur satellites must be under the control of a person holding an amateur station license. Communications from small satellites must be performed by amateurs for permitted amateur radio purposes such as self-training, intercommunication and technical investigation carried out by amateurs. The FCC defines amateurs as a "duly authorized person interested in radio technique solely with a personal aim and without pecuniary interest."[13]

To obtain an amateur license for satellite operations, the operator must supply a letter documenting coordination with the International Amateur Radio Union (IARU) which provides frequency coordination for amateur operations in designated frequency bands. All amateur frequency bands are shared and none are designated for exclusive use. The license holder is responsible for obtaining an ITU filing.

D. Orbital Debris Requirements

In recent years, orbital debris mitigation has become an increasingly essential part of satellite regulation. Orbital debris rules are currently in a state of flux, with significant changes for non-governmental satellite operators either proposed or going into effect in the near future. Given this uncertainty, entities likely to seek an FCC license in the near future should watch the FCC's activities closely to ensure that they are prepared to comply with any new or revised rules, or to provide comment as the FCC seeks additional feedback on its rules.

The FCC and Orbital Debris Mitigation. While the FCC's primary role in satellite regulation is assigning spectrum for commercial use, it also plays an important role in the regulation of orbital debris produced by commercial satellite operators. Since 2004, the FCC has required applicants for satellite licenses in the United States to comply with certain orbital debris mitigation requirements. Applicants for a satellite spectrum license must disclose certain measures taken to mitigate orbital debris produced by their satellites, including disclosure of whether the applicant has assessed and limited the amount of debris released during normal operations, whether the applicant plans any intentional release of debris, whether the applicant has assessed and limited the potential for collision of the satellite with other debris, and whether the applicant has assessed and limited the potential for onboard sources of stored energy to result in debris-producing explosions.

Applicants must also disclose the post-mission disposal plans for their satellites. For GSO satellites, the applicant must disclose the altitude at which the satellite will be disposed of following completion of its mission. For NGSO satellites where end-of-life disposal involves atmospheric reentry, applicants must include a casualty risk assessment showing an estimate of whether portions of the satellite are likely to survive reentry and the probability of human casualty caused by reentering debris. In all cases, applicants must explain how sources of stored energy will be passivated at end-

of-life to reduce the risk of accidental explosions following completion of their mission.[14]

Substantially the same orbital debris mitigation rules apply to operators of commercial, experimental, and amateur satellites. Foreign satellites operating in the U.S. under a grant of market access must generally submit the same information as U.S.-licensed systems, unless the non-U.S.-licensed operator demonstrates to the FCC that it is subject to effective orbital debris oversight by another administration.

For applicants applying under the streamlined small satellite process, the narrative orbital debris disclosure requirements are largely limited to certifications. Applicants under the streamlined process must certify that each of their satellites will release no operational debris, that the applicant has assessed and limited the probability of accidental explosions, has an in-orbit collision risk with other large objects that is 0.001 or less, and has a predicted casualty risk of zero. Small sat operators must also certify that the satellites will have a smallest dimension of no less than 10 cm, and that they would use a unique telemetry marker to allow the satellites to be differentiated from others. In the streamlined application, operators must include a narrative describing design and operational strategies to avoid collision with crewed spacecraft, such as the International Space Station (ISS).

While most satellites are authorized with disclosure of the basic debris mitigation information required in the FCC's rules, the FCC will often ask for applicants to submit additional information about their orbital debris mitigation plans. This is common for applications involving large satellite constellations or where an application raises unique issues from a debris mitigation perspective. In cases where a satellite system poses such unique risks, the FCC may impose additional debris mitigation requirements on a licensee as a condition of grant of a license.

2020 Update to FCC Debris Mitigation Rules. In April 2020, the FCC adopted its first comprehensive update to its orbital debris mitigation rules.[15] This effort by the FCC to update its rules was based on significant developments in the satellite industry in recent years, including rising numbers of small satellites and the development of megaconstellations. Many of the rules are based on standards developed by NASA,[16] as well as the U.S. government's Orbital Debris Mitigation Standard Practices (ODMSP), applicable to the activities of government satellite operations.[17]

The updated debris mitigation rules include the addition of specific metrics related to certain orbital debris risks, including metrics related to probability of on-orbit collision with other objects and human casualty risk. Applicants must also make additional disclosures related to satellite trackability, maneuverability, whether the satellite will engage in proximity operations with other satellites, and what measures have been taken to mitigate risk to the ISS and other inhabited spacecraft. While most of the updated rules are disclosure requirements, applicants must now certify that upon receipt of a space situational awareness conjunction warning, the operator will review and take all possible steps to assess the collision risk, and will mitigate the collision risk if necessary. The updated debris mitigation rules will apply to applications under the FCC's streamlined small satellite process, as well as experimental and amateur satellite authorizations.

Although the FCC adopted its updated orbital debris mitigation rules in April 2020, it is not yet clear when these rules will take effect or how many will ultimately apply. Rules adopted by the FCC do not take effect until after they are published in the Federal Register, and the April 2020 orbital debris rules have not been published as of the drafting of this white paper. Even once published, parties may file petitions with the FCC seeking reconsideration of its decisions, after which the FCC may decide to modify the final rules again before they take effect.

Ongoing FCC Orbital Debris Rulemaking. The FCC is currently seeking comment on potential further updates to its orbital debris mitigation rules. This ongoing rulemaking seeks comment on several significant modifications to the FCC's debris mitigation rules, including (a) requiring that satellites maintain maneuverability capabilities during all operations above a certain altitude; (b) requiring applicants to post a post-mission disposal bond that would be returned only if the operator successfully disposes of its satellites at end of life; and (c) requiring operators to indemnify the U.S. government for certain claims brought against the U.S. under international law. No specific filing deadline has been set for comments in this proceeding.

E. Earth Stations

Satellite communications with an earth station located in the United States typically require a separate FCC authorization to operate the U.S. earth station. Like space stations, earth stations can be authorized for commercial operations under Part 25 rules, for experimental operations under Part 5 rules, or for amateur operations under the Part 97 rules. Depending on the type of authorization, the FCC may authorize earth stations for as short as 30 days or for as long as 15 years. The appropriate type of earth station

authorization generally depends on the scope and duration of operations. Earth stations may be authorized under an individual license for specific locations or under a "blanket" license for multiple earth stations within a specified geographic area.

II. SPECTRUM ACCESS AND COORDINATION

A. Spectrum Access Generally

Spectrum is allocated for particular uses in the U.S. Table of Frequency Allocations, located in Section 2.106 of the FCC's rules.[18] The U.S. Table of Frequency Allocations is based on international allocations established by the International Telecommunication Union (ITU), but the U.S. table also includes U.S.-only allocations, and unlike other regions of the world, divides spectrum between federal and non-federal operations. Typically, satellites will be authorized to operate in spectrum allocated on the table for satellite use. Satellite operations must also generally conform to the type of service specified in the allocation, such as mobile-satellite service or fixed-satellite service. It is worth noting that the fact that a frequency band is allocated for satellite use is no guarantee that an applicant will be authorized to operate in that frequency band.

In limited circumstances the FCC will grant waivers of the Table of Frequency Allocations to allow satellite operations in frequency bands not normally allocated for such use. However, the FCC will only authorize such non-conforming operations on the condition that they do not cause interference to systems operating consistent with existing allocations. Applicants seeking waivers will also be required to submit an interference analysis or demonstration of coordination with incumbent operators to assure the FCC that incumbent operators will not suffer harmful interference. For spectrum use that does not conform with the U.S. Table of Frequency Allocations, applicants should meet with the FCC prior to filing an application. Applicants should not expect to routinely receive waivers from the FCC and whenever possible should attempt to operate under an existing satellite frequency allocation.

B. Domestic Coordination: NTIA

While the FCC is responsible for assigning frequencies for use by non-governmental satellite operators, it must still coordinate spectrum use with federal spectrum users in cases where spectrum is shared between federal and non-federal users. The U.S. Table of Frequency Allocations includes columns for Federal and non-Federal operations, and assignment of frequencies for federal use is handled by the National Telecommunications and Information Administration (NTIA), an agency within the U.S. Department of Commerce. Typically, coordination with NTIA is handled by the FCC as part of its standard application review process. However, in some cases it may be beneficial for operators to begin coordination with federal operators before applying to the FCC or while the application is being processed to facilitate the application process. In cases where federal operators may be affected by grant of a particular satellite license, the FCC may require ongoing coordination with federal operators or impose other special protections as conditions of the license grant.

C. International Coordination: ITU Filings

Pursuant to certain treaties between Member States, the ITU coordinates the use of spectrum by NGSO satellites to prevent international interference. Member States are required by ITU regulations to register with the ITU the frequencies and orbital slots/orbits that will be used by the GSO[19] and NGSO satellites that have been, or are expected to be, licensed by the Member States to private licensees. By registering frequencies with the ITU, Member States obtain international recognition for their space-based frequency assignments on a first-come, first-served basis. The registered frequency assignments are protected by ITU regulation from harmful interference caused by satellites later-registered with the ITU by other Member States.

International coordination and notification requirements exist regardless of which licensing regime the satellite operator chooses. Private parties do not directly interact with the ITU. Instead, satellite operators interact with the licensing administrations of their respective Member States, which, in turn, effectively represent the operators' interest before the ITU. The Member States' ITU registration filings generally are prepared by the Member State in close consultation with the private parties to which the Member States intend to issue satellite licenses.[20]

III. OTHER REGULATORY REQUIREMENTS

The FCC and the NTIA are not the only federal agencies that small satellite operators will encounter on the road to operations. Depending on the type of operations, other federal agencies play a role in small satellite regulation as well, including the Department of Commerce, the State Department, the Federal Aviation Administration, and NASA. The following sections provide a high-level overview of these agencies and their role in the small satellite regulatory process.

A. Department of Commerce

Housed within the Department of Commerce, the National Oceanic and Atmospheric Administration (NOAA) regulates remote sensing operations. While the Office of Space Commerce does not currently play a regulatory role in satellite operations, it is positioning itself to be a "one-stop shop" for commercial satellite operations in the United States.

NOAA – Commercial Remote Sensing Licensing. NOAA is responsible for issuing licenses for non-federal remote sensing operations pursuant to the 1992 Land Remote Sensing Policy Act.[21] While NOAA has regulated remote sensing operations for decades,[22] in May 2020 it comprehensively updated its remote sensing regulations for the first time since 2006.[23] The goal of these updated rules is to increase transparency and certainty for applicants and reduce regulatory burdens while preserving important policy objectives like national security. Notably, the new rules provide for three tiers of authorization based on the availability of the data that the applicant collects. Systems in Tier 1 provide data available elsewhere in the world, such as from foreign sources, and are subject to a bare minimum of requirements required by federal statute. Systems in Tier 2 provide data available only from U.S. sources, and could be subject to license restrictions given that there is no foreign competition for the data. Systems in Tier 3, which provide novel data that is not currently available in the U.S. or elsewhere in the world, will be subject to more stringent conditions developed in coordination with the Departments of Defense and State. Other notable revisions to NOAA's rules include eliminating the possibility of the agency unilaterally adding license conditions after issuance of the license and reducing review time for applications from 120 to 60 days.

As part of its oversight of commercial remote sensing, NOAA has also played a role in orbital debris mitigation regulation for non-governmental entities, and has imposed orbital debris mitigation requirements on commercial remote sensing satellite operators for nearly 15 years. However, in its 2020 revisions to its rules, NOAA substantially revised its orbital debris mitigation requirements by generally eliminating such requirements in cases where a system is subject to the FCC's orbital debris mitigation rules.[24]

Office of Space Commerce. The Office of Space Commerce, which is housed within NOAA, is responsible for promotion of economic growth and advancement of the U.S. commercial space industry.[25] Although the Office does not currently play a regulatory role, it may occupy such a role in the future, particularly with regard to space traffic management and space situational awareness. Pursuant to the 2018 Space Policy Directive-3,[26] the Office of Space Commerce released a Request for Information seeking comment on space traffic management (STM), space situational awareness (SSA), and orbital debris mitigation, including appropriate regulatory structures that should be adopted to drive the development and responsible use of such SSA and STM enhancements to protect national interests and further encourage U.S. commercial space investment.[27]

B. U.S. Department of State

U.S. Registry for Space Objects and Launch Oversight. The U.S. Department of State's Office of Space and Advanced Technology (SAT) maintains the official U.S. registry of objects launched into outer space. This registry is consistent with the requirements of the U.N. Convention on the Registration of Objects Launched into Outer Space (Registration Convention) which provides that Member States maintain a national registry of objects launched into Earth orbit or beyond, and report information from that registry to the International Register registry maintained by the United Nations.[28] The Department of State tracks space objects where the United States either launches or procures the launch of a space object, or launches a space object from its territory. Along with the Bureau of Oceans and International Environmental and Scientific Affairs (OES), SAT executes the Department of State's responsibility to consult with the FAA on any aspects of commercial space launch and reentry licensing that affect foreign policy.

Export Control Regulation. Given the international nature of many aspects of the satellite industry, from supply chains to launch services, small satellite operators are likely to encounter U.S. export control regulations. The export of technologies used for rockets and satellites is subject to complex and stringent regulation by multiple government agencies in the United States, including the Department of State, which is responsible for administering the International Traffic in Arms Regulations (ITAR),[29] the Bureau of Industry and Security within the Department of Commerce, which administers the Export Administration Regulations (EAR),[30] and the Office of Foreign Asset Control (OFAC) within the Department of the Treasury, which maintains lists of individuals, groups, and companies that are subject to U.S. sanctions.[31] The extent to which these and other federal regulations apply to the activities of any particular small satellite operator subject to a case-specific analysis that is beyond the scope of this paper, but small satellite operators should be generally aware of the role that these agencies play.

C. FAA

The Federal Aviation Administration (FAA) oversees commercial launches taking place within U.S. borders and launches conducted overseas by U.S. entities. The FAA's launch regulations require a license or a permit for all such commercial launches.[32] The FAA does not generally license launches by U.S. government organizations. A satellite operator must have an authorization from a regulatory body before the satellites may be integrated into a launch vehicle and launched.[33] Launching a satellite without an authorization could subject the satellite operator to FCC enforcement action.[34]

D. NASA

Although not a regulatory agency, NASA plays a central role in space policy in the United States and has significant influence on the rules adopted by regulatory agencies. NASA has played a key role in developing standards for orbital debris mitigation, which have been incorporated both into the federal government's ODMSP and the FCC's rules on orbital debris mitigation. Demonstrating compliance with NASA standards is often an important step in the regulatory process, and even where not specifically required NASA standards are often seen as best practices for space operations.

IV. CONCLUSION

As small satellite operators design their innovative satellite systems, they should do so with an eye toward U.S. satellite and launch regulations. In particular, operators should familiarize themselves with FCC space station and earth station authorization processes and dedicate sufficient time to obtain authorizations before a satellite system may be launched and commence operations. It is also important to be aware of the U.S. and international components of spectrum access and the other U.S. federal agencies that play a role in small satellite regulation in the United States.

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[1] This White Paper provides an overview of U.S. regulations for small satellites. It does not constitute legal advice nor should it be considered an agreement to represent individuals or satellite companies. This White Paper represents the views of the authors and should not be construed as representing the views of Wilkinson Barker Knauer LLP or its clients. Satellite regulatory compliance is a complicated process and the authors recommend seeking assistance from a qualified professional before engaging in these processes.

[2] *Streamlining Licensing Procedures for Small Satellites*, Report and Order, FCC 19-81 (rel. Aug. 2, 2019) (*Small Satellite Report and Order*). A copy of the FCC's Small Satellite Report and Order is available here: https://docs.fcc.gov/public/attachments/FCC-19-81A1.pdf. The rules governing streamlined small satellite application process are expected become effective in 2020.

[3] Specifically, applicants must complete FCC Form 312 and the associated Schedule S. Form 312 is available here: https://transition.fcc.gov/Forms/Form312/312Fill.pdf. Instructions for Schedule S are available here: https://enterpriseefiling.fcc.gov/schedules/resources/Instructions%20for%20Schedule%20S%20vApr2016.pdf.

[4] The FCC determined that non-propulsive means of maneuverability, such as relying on differential drag or solar sails, would not provide sufficient maneuverability for operations above 600 km under the process.

[5] Some of the streamlined small satellite rules related to orbital debris mitigation may be revised pending outcome of the FCC's ongoing orbital debris proceeding.

[6] The FCC requires all authorized satellite operators to post a surety bond after grant of an authorization to operate to prevent operators from sitting on spectrum resources and preventing others from using them, an act referred to as "spectrum warehousing." Operators who successfully launch and operate their satellites consistent with their authorization will recover the value of their bond, while operators who receive an authorization and fail to deploy their system will forfeit the value of their bond. The FCC's bond requirement is discussed in 47 C.F.R. § 25.165.

[7] *Small Satellite Report and Order*, para. 30.

[8] *Streamlining Licensing Procedures for Small Satellites*, Notice of Proposed Rulemaking (NPRM), 33 FCC Rcd 4152, 4154, para. 3. A copy of the NPRM can be found here: https://docs.fcc.gov/public/attachments/FCC-18-44A1.pdf.

[9] Foreign licensed NGSO Satellites operating pursuant to a grant of market access under the regular Part 25 authorization are not granted for a specific period of time. Rather, the market access grant is valid for the period of time that an NGSO system is operating or the

period of time that a GSO satellite continues to operate at a particular orbital location.

[10] In recent years, the FCC has initiated multiple processing rounds including a Ka-/Ku-band processing round when it accepted OneWeb's NGSO application for filing on July 15, 2016; an additional processing round for portions of spectrum that other Ka-/Ku-band processing round on May 26, 2017; a third Ku/Ka-band processing round NGSO operations that closed on May 26, 2020; a V-band NGSO applications processing round that was initiated by a Boeing V-band application; and a processing round for NVNG MSS operations that was initiated by applications from and Myriota, Hiber and Spire Global and closed on October 15, 2019.

[11] Most operators post a bond in the amount of $1,670,000 to cover the initial million-dollar payment and the following 12 months of the surety bond.

[12] 47 C.F.R. § 25.164.

[13] 47 C.F.R. § 97.3.

[14] The detailed FCC rules on orbital debris mitigation can be found in Part 25 of the FCC's rules. *See* 47 C.F.R. §25.114(d)(14).

[15] *Mitigation of Orbital Debris in the New Space Age*, Report and Order and Further Notice of Proposed Rulemaking, FCC 20-54 (rel. Apr. 24, 2020). A copy of the report and order is available here: https://ecfsapi.fcc.gov/file/04240586604013/FCC-20-54A1.pdf

[16] For example, the FCC adopted debris mitigation metrics related to collision with small objects and casualty risk based on standards developed by NASA.

[17] U.S. Government Orbital Debris Mitigation Standard Practices, November 2019 Update, https://orbitaldebris.jsc.nasa.gov/library/usg_orbital_debris_mitigation_standard_practices_november_2019.pdf.

[18] 47 C.F.R. § 2.106. The FCC maintains an unofficial version of the U.S. Table of Frequency Allocations here: https://transition.fcc.gov/oet/spectrum/table/fcctable.pdf

[19] The ITU divides the world into three regions for the purpose of managing global radio spectrum use, and GSO orbital slots that are located above a particular region are allocated to Member States in that region. Region 1 covers Europe, Africa, the former Soviet Union, Mongolia and the Middle East west of the Persian Gulf. Region 2 covers North and South America. Region 3 covers Asia, the remaining countries in the Middle East including Iran and most of Oceania. The Atlantic Ocean is located in both Regions 1 and 2 and the Pacific Ocean is located in Regions 2 and 3. A map of the regions can be found here: https://www.itu.int/net/ITU-R/index.asp?category=information&rlink=emergency-bands&lang=en.

[20] To prevent the warehousing of satellite registration, an ITU registration must be brought into use (BIU) within seven years to remain in effect. Bringing into use requirements for NGSO constellations require NGSO operators to deploy 10% of their constellation within 2 years after the end of the current regulatory period for bringing into use, 50% within 5 years and complete the deployment within 7 years.

[21] 51 U.S.C. § 60101 *et seq*.

[22] NOAA's regulations applicable to remote sensing satellites can be found in Part 960, of Title 15 Code of Federal Regulations.

[23] *Licensing of Private Remote Sensing Space Systems*, Final Rule, 85 FR 30790 (2020). As of the drafting of this white paper, the update rules are scheduled to go into effect on July 20, 2020.

[24] *Licensing of Private Remote Sensing Space Systems*, 85 FR at 30799.

[25] Office of Space Commerce, Mission, https://www.space.commerce.gov/about/mission/.

[26] Space Policy Directive-3, National Space Traffic Management Policy, Presidential Memorandum (issued Jun. 18, 2018), https://www.whitehouse.gov/presidential-actions/space-policy-directive-3-national-space-traffic-management-policy/.

[27] *Request for Information on Commercial Capabilities in Space Situational Awareness Data and Space Traffic Management Services*, Notice and Request for Comments, 84 FR 14645 (2019).

[28] Convention on Registration of Objects Launched into Outer Space, Articles II-IV (Sept. 15, 1976).

[29] An unofficial version of the ITAR can be found on the State Department's website here: https://www.pmddtc.state.gov/ddtc_public?id=ddtc_kb_article_page&sys_id=%2024d528fddbfc930044f9ff621f961987.

[30] An unofficial version of the EAR can be found on the Department of Commerce's website here:

.https://www.bis.doc.gov/index.php/regulations/export-administration-regulations-ear.

[31] Information on OFAC can be found on the Department of the Treasury's website here: https://www.treasury.gov/resource-center/sanctions/Pages/default.aspx.

[32] The FAA's launch regulations are located in Chapter III, Parts 400 to 460, of Title 14 Code of Federal Regulations.

[33] An authorization from the FCC or a foreign regulatory authority is a condition precedent to a satellite to be legally launched. "Launch service providers should be aware that a satellite integrated into a launch vehicle or deployment device without a current FCC authorization may need to be removed from that vehicle or deployment device if the satellite operator's application for an FCC authorization is not acted upon favorably, or for various reasons cannot be granted within a time frame consistent with the launch schedule." *Compliance with Satellite Communications Licensing Requirements is Mandatory and Failure to Comply Can Result in Enforcement Action*, Enforcement Advisory, Public Notice, DA 18-368, Enforcement Advisory No. 2018-01 (Apr. 12, 2018).

[34] *Id.*